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RESEARCH ARTICLE

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Global and regional IUCN Red List assessments: 7

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Abstract

In this contribution, the conservation status assessment of four vascular plants according to IUCN categories and criteria are presented. It includes the assessments of *Aurinia leucadea* (Guss.) K.Koch, *Chondrilla chondrilloides* (Ard.) H.Karst., *Daphne cneorum* L., and *Ophioglossum azoricum* C.Presl at regional level (Italy).

Keywords

conservation, extinction risk, IUCN protocol, threats

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How to contribute

The text of the global and regional assessments should be submitted electronically to Simone Orsenigo (simone.orsenigo@unimi.it) or to Giuseppe Fenu (gfenu@unica.it); the text, up to 8000 characters in length (spaces included), must include a distribution map and a picture of the assessed species.

Red List Assessments

Aurinia leucadea (Guss.) K.Koch

Regional assessment (Italy)
Taxonomy and nomenclature
Order: Brassicales *Family:* Brassicaceae

Aurinia leucadea (Guss.) K.Koch, Hort. Dendrol.: 23 (1853) ≡ *Alyssum leucadeum* Guss., Pl. Rar.: 268(-269) (1826) = *Aurinia scopulorum* (Ginzb.) Trinajstić, Suppl. Fl. Anal. Jugosl. 8: 5 (1982) = *Aurinia leucadea* (Guss.) K.Koch subsp. *diomedea* Brullo, De Marco & Giusso, Inform. Bot. Ital. 35(1): 243 (2003) = *Aurinia leucadea* (Guss.) K.Koch subsp. *scopulorum* (Ginzb.) Plazibat, Nat. Croat. 18(2): 416 (2009).

Common name: Alisso di Leuca (It), Leuca Alison (En).

Geographic distribution range: *Aurinia leucadea* (Fig. 1) is endemic to Italy and Croatia (Plazibat 2009). It was erroneously reported from Ukraine (Euro+Med 2006), probably due to confusion between *Alyssum medium* Host and *Alyssum medium* A.P.Iljinsk., nom. illeg., and from the former Serbia & Montenegro (Euro+Med 2006, based on Trinajstić 1982 in which, however, the species is indicated only for Croatia under the name *A. scopulorum*). In Italy, it occurs only in Puglia, in two disjunct areas (Salento and Tremiti Islands). In Salento, this species occurs in many localities between Punta Palascia (Otranto) and Leuca, whereas its occurrence between Leuca and Torre Uluzzo (Nardò) is discontinuous. The indication for Torre Inserraglio (Tornadore 1981) is probably due to confusion with Torre Uluzzo. On the Tremiti Islands, *A. leucadea* occurs on the islands of San Nicola and Capraia (Fig. 2).

Distribution: Countries of occurrence: Italy and Croatia.

Biology: *Plant growth form:* Perennial (chamaephyte). *Chromosome number:* $2n = 16$ (material from Salento, Tornadore 1981).

Flowering and fruiting time: Flowering from March to May, fruiting from April to late May.

Reproduction: Pollination by bees, dispersal by seeds. Germination tests on material collected on the Tremiti Islands (L. Forte and collaborators, unpublished

Figure 1. *Aurinia leucadea* photographed in Torre Minervino (Salento, Italy). Picture by P. Medagli.

data) show that the seeds have no mucilage on the teguments, in contrast with the seeds of other taxa of the same genus [e.g., *A. saxatilis* (L.) Desv. subsp. *megalocarpa* (Hausskn.) T.R.Dudley] or of the genus *Alyssum*. Consequently, *A. leucadea* cannot benefit from the ecological advantages that the presence of seed mucilage implies in the reproductive biology of a species (Sun et al. 2012, Yang et al. 2012). In addition, *A. leucadea* does not show any type of dormancy, given that the seeds can germinate, even at very high rates (> 95%), in the dark and at a constant temperature ranging between 3 and 21°C. Only at a constant temperature of 24°C in the dark, the germination rate drops to about 50% (L. Forte and collaborators, unpublished data).

Habitat and ecology: In Italy, *A. leucadea* grows on calcareous rocks near the sea, up to about 75 m a.s.l. In Salento, the species is characteristic of the association *Campanulo versicoloris-Aurinietum leucadeae* Bianco, Brullo, Pignatti & Pignatti, 1988 (Bianco et al. 1988).

Population information: There is no available detailed information on population dynamics. The populations seem to be stable.

Threats: *1.3 Tourism & Recreation areas:* All the occurrence sites in Italy are affected by possible stronger anthropization of the coast, especially by the development

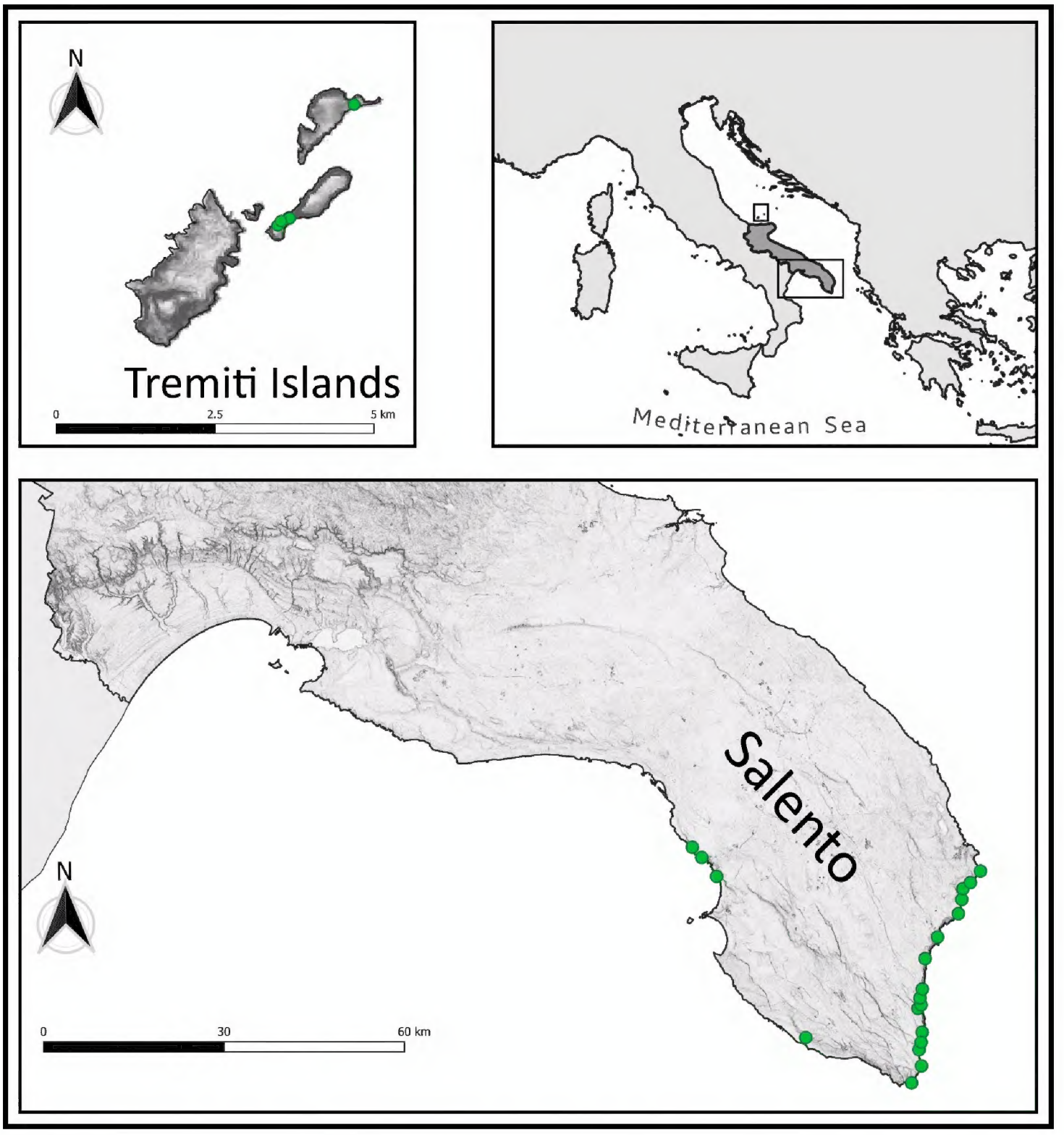

Figure 2. Geographic range and distribution map of *Aurinia leucadea* in Italy.

of touristic infrastructures. However, considering that *A. leucadea* grows on rocky habitats, this threat is more hypothetical than real and, in any case, it would affect only specific areas and not the sites where the species mostly occurs.

5.2 Gathering terrestrial plants: The population growing on the Fortress-Abbey of Santa Maria a Mare on the Island of San Nicola (Tremiti) is threatened by the projected cleaning of the walls of the ancient Abbey. Considering the low number of individuals of *A. leucadea* growing on the Tremiti Islands, the cleaning could have a considerable impact on the population of San Nicola.

CRITERIA APPLIED:

Criterion B: **AOO:** 84 km^2 calculated with a 2 × 2 km-cell fixed grid by GeoCAT (Bachman et al. 2011)

EOO: 7,483 km^2 calculated with minimum convex hull by GeoCAT (Bachman et al. 2011).

a) Not severely fragmented; number of locations > 10

b) No continuing decline

Red List category and criteria (regional assessment)

LC	Least Concern

Rationale for the assessment: In Italy, *Aurinia leucadea* occurs only in Puglia, with many localities on the rocky coast of Salento and with a small population on the Tremiti Islands. The habitat of this species is quite conservative and neither continuing decline nor extreme fluctuations have been observed or can be projected. The distribution is not severely fragmented and the identified threats are only potential in most of the occurrence sites. Only the population on San Nicola (Tremiti Islands) is affected by a concrete threat (5.2). Therefore, the species is assigned to the Least Concern (LC) category.

Previous assessment: At the Regional level (Italy), this species was previously indicated as Endangered (EN) (Wagensommer et al. 2013). At a global level, it has not been evaluated (NE) to date (IUCN 2019).

Conservation actions: *Aurinia leucadea* is unprotected by international, national and regional laws. Accessions collected in 2010 on San Nicola (Tremiti Islands) are stored *ex situ* in the Germplasm Bank of the Botanical Garden Museum of the University of Bari "Aldo Moro" (BG-MOBB) (Forte et al. 2015). The Salento sites are included in the Regional Natural Parks "Costa Otranto-Santa Maria di Leuca e Bosco di Tricase", "Litorale di Ugento" and "Porto Selvaggio e Palude del Capitano", and in the Natura 2000 sites "Costa Otranto-Santa Maria di Leuca" (SCI IT9150002), "Litorale di Ugento" (SCI IT9150009), "Montagna Spaccata e Rupi di San Mauro" (SCI IT9150008), and "Torre Uluzzo" (SCI IT9150007). The sites on the Tremiti Islands are included in the Gargano National Park and in the Natura 2000 site "Isole Tremiti" (SAC/SPA IT9110011).

Conservation actions needed: Research activities are recommended in order to better understand the reproductive biology and the population dynamics of this species; monitoring programs are encouraged in order to evaluate the possible development of threats. The increase in the number of accessions in seed banks for *ex situ* conservation is desirable, especially regarding the Salento sites.

Notes: According to some authors (Brullo et al. 2003, Plazibat 2009), the populations from the Tremiti Islands (and from two Croatian islands, Kamik and Jabuka) might be distinguished at subspecific rank, as *A. leucadea* (Guss.) K.Koch subsp. *diomedea* Brullo, De Marco & Giusso, but the latter taxon is not recognised in the recent checklist of the

Italian vascular flora (Bartolucci et al. 2018). By considering them as two different taxa, the Regional assessments (Italy) would be as follows: *A. leucadea* subsp. *leucadea* Least Concern (LC), *A. leucadea* subsp. *diomedea* Endangered [EN B1ab(iii,v)+2ab(iii,v)].

R.P. Wagensommer, P. Medagli, L. Forte

Chondrilla chondrilloides (Ard.) H.Karst.

Regional Assessment (Italy)
Taxonomy and nomenclature
Order: Asterales *Family:* Asteraceae

Chondrilla chondrilloides (Ard.) H.Karst., Deut. Fl.: 1139. 1883 ≡ *Prenanthes chondrilloides* Ard. (basionym), Animadv. Bot. Spec. Alt.: 36 (1764)

Common name: Condrilla falsa condrilla (It), Lattugaccio dei torrenti (It), Alpen-Knorpelsalat (De), Chondrille faux Prénanthe (Fr)

Geographic distribution range: *C. chondrilloides* (Fig. 3) is endemic to the eastern Alps, growing in Switzerland, Germany, Austria, Italy, and Slovenia (Euro+Med 2006, Prosser 2017).

In Italy, *C. chondrilloides* occurs in Trentino-Alto Adige, Veneto, and Friuli Venezia Giulia (Fig. 4), while it is considered extinct in Lombardia (Poldini 2002, Prosser 2017, Bartolucci et al. 2018). Its Italian distribution range is in regression, because several populations have not been confirmed in recent times (Prosser 2017).

Distribution: Countries of occurrence: Austria, Germany, Italy, Slovenia, and Switzerland.

Biology: *Plant growth form:* herbaceous perennial (hemicryptophyte).

Flowering time: From June to August.

Reproduction: According to Bergman (1952), *C. chondrilloides* is a diploid species reproducing amphimictically. No information on pollination, dispersal strategy, and seed germination is available.

Habitat and ecology: *Chondrilla chondrilloides* typically grows in stony riverbeds and riverbanks of montane rivers and streams, in particular on calcareous substrates. It is a stenoecious species, strictly linked to riverbanks subject to natural dynamics, while it is lacking in man-modified riverine habitats. It can be considered a typical member of the Habitat Natura 2000 code 3220 "*Alpine rivers and the herbaceous vegetation along their banks*" but, to a lesser extent, it can also be found in the habitats "*Alpine rivers and their ligneous vegetation with Myricaria germanica*" and "*Alpine rivers and their ligneous vegetation with Salix eleagnos*" (codes 3230 and 3240, respectively, of the Habitat Directive 92/43/EEC).

Population information: Populations range from few to hundreds of individuals, up to a maximum of 1800–2000 at a single site (riverbed of Centa stream in Caldon-

Figure 3. *Chondrilla chondrilloides* photographed in Caldonazzo (Trento, Italy). Picture by F. Prosser.

azzo, Prosser 2017). Many of the past sites of occurrence documented by herbarium specimens and field surveys were not recently confirmed. In some sites, the species was surely present and abundant in 1997–1998, and completely lacking in 2014–2016

(Prosser 2017). There is no other detailed information available on population dynamics and trends.

Threats: *3.2 Mining & Quarrying*: in Valsugana, the extraction of gravel and sand from river beds, and the consequent modification of hydrodynamics, can interfere with the normal development of the herbaceous vegetation of the banks.

6.1 Recreational Activities: in Friuli, sport activities that involve the use of motorized vehicles (such as off-road vehicles) on gravelly riverbanks can threat populations.

7.2.9 Small Dams: construction of dams alters the fluvial regime and the morphological features of the banks of the downstream reaches.

7.3 *Other ecosystem modifications*: removal of snags from streams, management and containment of the rivers and river banks maintenance could damage the populations of *C. chondrilloides*.

8.1.2 Invasive Non-Native/Alien Species/Diseases: in some sites the quick expansion of *Impatiens glandulifera* Royle and *Reynoutria japonica* Houtt. can pose a serious threat to the species.

CRITERIA APPLIED:

Criterion B: **AOO:** 168 km^2 calculated with a 2×2 km-cell fixed grid.

EOO: 11,156 km^2 calculated with minimum convex hull in QGis 2.18.9.

b) Documented decline in (i) extent of occurrence; (ii) area of occupancy; (iii) area, extent and/or quality of habitat; (iv) number of locations or subpopulations; (v) number of mature individuals.

c) Extreme fluctuations in (ii) area of occupancy; (iii) number of locations or subpopulations, due to the habitat types in which it occurs (riparian natural dynamics, anthropic disturbances).

Red List category and criteria (regional assessment)

EN	**Endangered**	**B2b(i,ii,iii,iv,v)c(ii,iii)**

Rationale for the assessment: *Chondrilla chondrilloides* is endemic to the eastern Alps, growing in montane riverbanks and riverbeds subjected to natural dynamics. The anthropic modifications and exploitations of riverine habitats have caused a reduction in AOO. Moreover, *C. chondrilloides* populations are subjected to extreme fluctuations due to riparian system dynamics. Because of the overall decline of EOO, AOO, habitat quality, number of populations, and number of mature individuals this taxon qualifies as Endangered at a regional level (Italy).

Previous assessment: *Chondrilla chondrilloides* was not previously evaluated (NE) neither at national (Italy) nor at global level (NE, IUCN 2019). In the other countries of occurrence, *C. chondrilloides* is included in national red lists, as EN in Switzerland (www.infoflora.ch), Germany (www.floraweb.de), and Austria (Niklfeld & Schratt-Ehrendorfer 1999), or as VU (Vulnerable) in Slovenia (Anonymous 2002).

Conservation actions: *Chondrilla chondrilloides* is not protected by international or Italian laws, while it is protected or included in attention lists in Switzerland, Ger-

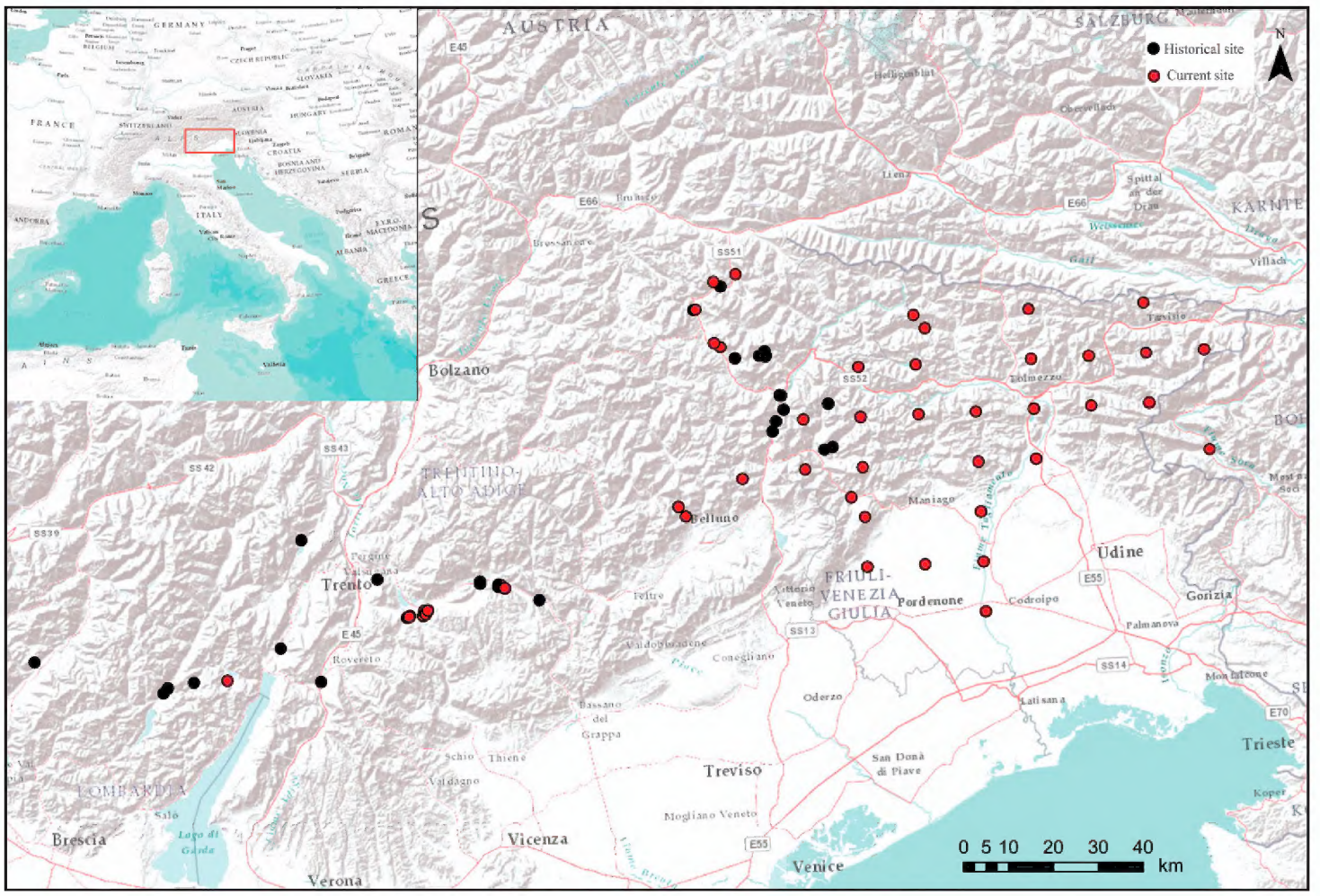

Figure 4. Geographic range and distribution map of *Chondrilla chondrilloides* in Italy (black dots: historical sites not recently confirmed; red dots: current/confirmed sites).

many, Austria, and Slovenia. Some of the Italian sites (33%) are included in the Natura 2000 protected areas network.

Conservation actions needed: Further monitoring and research activities are recommended in order to better understand the species' population trends in Italy.

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Daphne cneorum L.

Regional Assessment (Italy)

Taxonomy and nomenclature

Order: Malvales *Family:* Thymelaeaceae

Daphne cneorum L., Sp. Pl.: 357. 1753

Common name: Dafne odorosa (It), Cneoro (It), Rose daphne (En)

Geographic distribution range: *Daphne cneorum* (Fig. 5) is an orophilous central-southern European species, and it grows in mountain and sub-mountain areas from Spain to central European Russia, being particularly widespread in alpine and Balkan

Figure 5. *Daphne cneorum* in Piedmont (Italy). Picture by Alberto Selvaggi.

areas (Euro+Med 2006). In Italy, *D. cneorum* has been reported for Piemonte, Lombardia, Trentino-Alto Adige, Veneto, Friuli Venezia Giulia, Liguria, Emilia-Romagna, and Toscana (Fig. 6; Bartolucci et al. 2018).

Distribution: Countries of occurrence: Albania, Andorra, Austria, Bulgaria, Czech Republic, Croatia, France, Germany, Hungary, Italy, Republic of Macedonia, Poland, Romania, Russia (central European), Serbia, Slovakia, Slovenia, Spain, Switzerland, and Ukraine (Euro+Med 2006).

Biology: *Plant growth form:* small evergreen shrub (chamaephyte/nano-phanerophyte).

Flowering time: From April to July.

Reproduction: *Daphne cneorum* probably reproduces amphimictically by seeds, which could be dispersed by birds, even if detailed information on reproduction, pollination, dispersal strategy, and seed germination is poor or absent. Several literature sources report that *Daphne* species, and specifically *D. cneorum,* have low reproductive potential (Melnik 1997, Malà and Bylinsky 2004).

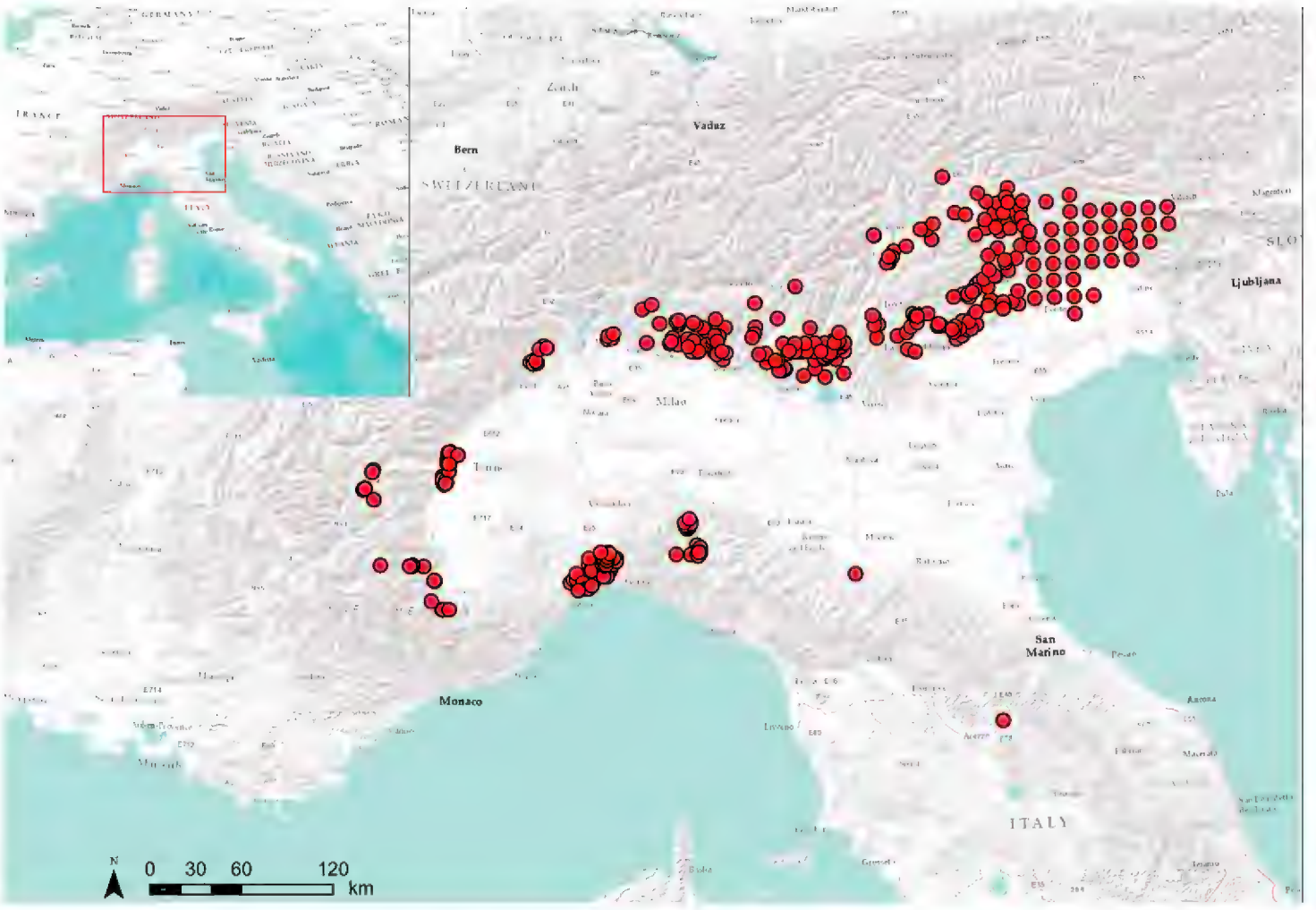

Figure 6. Geographic range and distribution map of *Daphne cneorum* in Italy.

Habitat and ecology: *Daphne cneorum* typically grows in relatively warm, dry, stony areas, screes, low grasslands, rocky steppes, shrublands, and open oak woods (*Quercus pubescens* Willd. or *Q. petraea* (Matt.) Liebl.), pine woods (*Pinus sylvestris* L., *P. nigra* J.F.Arnold) or conifer plantations, particularly on poor soils on basic (limestone, dolomite), mafic or ultramafic substrata (peridotite, serpentine, basalt, gabbro, lherzolite). This species grows at altitudes between 350 and 1700 m a.s.l., from the plain to the subalpine level; occasionally, some populations can also be found in dry grasslands and gravel beds in the lowlands, floated down by rivers and streams. *Daphne cneorum* can be found in several different habitats listed in Annex I of the Habitats Directive 92/43/EEC (e.g., code 5130, *Juniperus communis* formations on heaths or calcareous grasslands; code 6130, Calaminarian grasslands of the *Violetalia calaminariae*; code 6210, semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*); code 62A0, eastern sub-Mediterranean dry grasslands (*Scorzoneretalia villosae*); code 8120, calcareous and calcschist screes of the montane to alpine levels (*Thlaspietea rotundifolii*); code 8130, western Mediterranean and thermophilous screes, etc).

Population information: In each site, the subpopulations generally consist of few to tens of individuals, reaching hundreds of individuals only in a few sites. There is no information available on population dynamics.

Threats: *2.2.1 Small-holder plantations*: in the ophiolitic sites, resinous plantations often occur.

3.2 Mining and quarrying: the extraction of gravel and sand from river beds, and the consequent modification of hydrodynamics, can interfere with the normal development of the herbaceous vegetation of the gravel river banks, where *D. cneorum* can be found.

4.1 Roads and railroads: D. cneorum can occur on rocks along roadsides, where it can be threatened by road safety or enlargement works.

5.2.1 Gathering terrestrial plants, intentional use: the plant is harvested because of the attractiveness and fragrance of the flowers. Locally, as in Givoletto (Torino; Selvaggi 2009), the wild plants were traditionally collected in spring and commercialized. In general, *D. cneorum* is one of the most popular shrubs among floriculturists and the introduction of wild *Daphne* species into breeding programs (*in vitro* cultures) is currently being pursued because of their natural resistance to fungal root pathogens (Wiszniewska et al. 2013).

6.1 Recreational activities: in Friuli Venezia Giulia, sport activities that involve the use of motorized vehicles (such as off-road vehicles) on gravel river banks can threaten lowland populations.

7.2.9 Small dams: construction of dams alters the fluvial regime and the morphological features of the banks of the downstream reaches.

7.3. Other ecosystem modifications: natural habitat evolution (development of shrubs, e.g., *Erica scoparia* L., *Juniperus* sp. pl., or closing of the canopy layer of pine formations) threatens some sites, particularly the ophiolitic ones.

9.3 Agricultural and forestry effluents: lowland sites may be affected by pollution resulting from widespread areas of intensive agriculture (nutrient load, herbicides, and pesticides).

8.1.2 Invasive non-native/alien species/diseases: lowland sites along gravel riverbanks may be affected by invasive species, such as *Buddleja davidii* Franch. and *Senecio inaequidens* DC.

CRITERIA APPLIED:

Criterion B: **AOO:** 1,396 km^2 calculated with a 2×2 km-cell fixed grid

EOO: 118,173 km^2 calculated with minimum convex hull in QGis 2.18.9

a) Number of locations: > 10

b) Decline in quality and extent of habitat (iii)

Red List category and criteria (regional assessment)

LC	Least Concern

Rationale for the assessment: *Daphne cneorum* is an orophilous central-southern European species, that grows in several northern and central Italian Regions. It has an extent of occurrence of *ca.* 118,000 km^2 and an area of occurrence of *ca.* 1,400 km^2. Despite the small size of most populations, the various threats and the observed decline in quality and extent of the habitat, there is no evidence of a decline. For this reason, this *taxon* is assessed as Least Concern at Regional level (Italy).

Previous assessment: *Daphne cneorum* was not evaluated (NE) previously, neither at a global (IUCN 2019) nor regional level (Italy). In many other countries, *D. cneorum* (*D. cneorum* subsp. *cneorum* and/or *D. cneorum* subsp. *arbusculoides* (Tuzson) Soó) is included in national red lists, assessed as EN (Endangered) in Switzerland, Croatia, Bulgaria, and CR (Critically Endangered) in Czech Republic and Germany (http://www.nationalredlist.org/).

Conservation actions: *Daphne cneorum* is not protected at national or international levels, while it is protected or included in attention lists at a local level: it is protected by Regional laws in Liguria (L.R. 9/1984), Piemonte (L.R. 32/1982), Lombardia (L.R. 10/2008), Veneto (L.R. 53/1974 and DPGR 1475/1982), and Emilia-Romagna (L.R. 2/1977); it is included in an attention plant list in Toscana. (REpertorio NAturalistico TOscano http://www502.regione.toscana.it/geoscopio/arprot.html). Some of the Italian sites (44%) are included in protected areas of the Natura 2000 network.

Conservation actions needed: Further monitoring and research activities are recommended in order to better understand the population trends of the species in Italy, especially in the peripheral locations, as well as reproductive and biological traits relevant for its conservation. Where not yet protected, it would be strongly advisable to include it in lists of plants whose collection is prohibited by Regional laws.

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Ophioglossum azoricum C.Presl

Regional Assessment (Italy)

Taxonomy and nomenclature

Order: Ophioglossales *Family*: Ophioglossaceae

Ophioglossum azoricum C.Presl, Suppl. Tent. Pterid.: 49 (1845) = *Ophioglossum sabulicolum* Sauzé & Maillard = *Ophioglossum vulgatum* L. subsp. *ambiguum* (Coss. & Germ.) E.F.Warb.

Common name: Small Adder's-tongue (En), Ophioglosse des Açores (Fr), Ofioglosso delle Azzorre (It).

Geographic distribution range: *Ophioglossum azoricum* (Fig. 7) is an Atlantic-Mediterranean species found in the Macaronesian Islands (Azores, Madeira, Canary Islands), coastal Greenland, and across western and southwestern Europe to central Europe and further east (Cyprus and Turkey) where it is very localized (Christenhusz et al. 2017). In the past, it was repeatedly reported for Italy, in Sardegna, Toscana (Apuan Alps and Monte Pisano mountain range), Lazio, and Veneto (Argenti et al. 2013, Peruzzi et al. 2015). Currently, its occurrence is confirmed only for Lazio, in the Selva

Figure 7. *Ophioglossum azoricum* photographed in the Selva del Lamone (Ischia di Castro, Viterbo, Latium). Picture by S. Magrini.

del Lamone (Ischia di Castro, Viterbo; Fig. 8) (Argenti et al. 2013); the record from Sardegna is erroneous (Marchetti, 2004), the two known populations in the Apuan Alps are considered extinct, the current populations from Monte Pisano are hybrids (Peruzzi et al. 2015), and the hexaploid population from Veneto is actually morphologically closer to *O. vulgatum* (Argenti et al. 2013, Peruzzi et al. 2015).

Distribution: Countries of occurrence: Belgium, Cyprus, Czech Republic, France (Corsica, mainland France), Great Britain, Iceland, Ireland, Italy, Netherlands, Poland, Portugal (Azores, Madeira, mainland Portugal), Spain (Canary Islands, mainland Spain), and Turkey (Christenhusz et al. 2017).

Biology: *Plant growth form*: perennial (rhizomatous geophyte).

Sporulation time: From April to June.

Reproduction: *Ophioglossum azoricum* is an eusporangiate fern with subterranean achlorophyllous mycoheterotrophic gametophytes. Sporophytes are initially subterranean, achlorophyllous and mycoheterotrophic, while a mutualistic symbiosis characterizes the photosynthetic stage of the sporophyte (Field et al. 2015). The sporangia have no specialised dehiscence mechanism.

Habitat and ecology: *Ophioglossum azoricum* grows in low-lying, damp, sandy-peaty habitats, such as dune slacks, cliff-tops and turf along the coast, heaths and

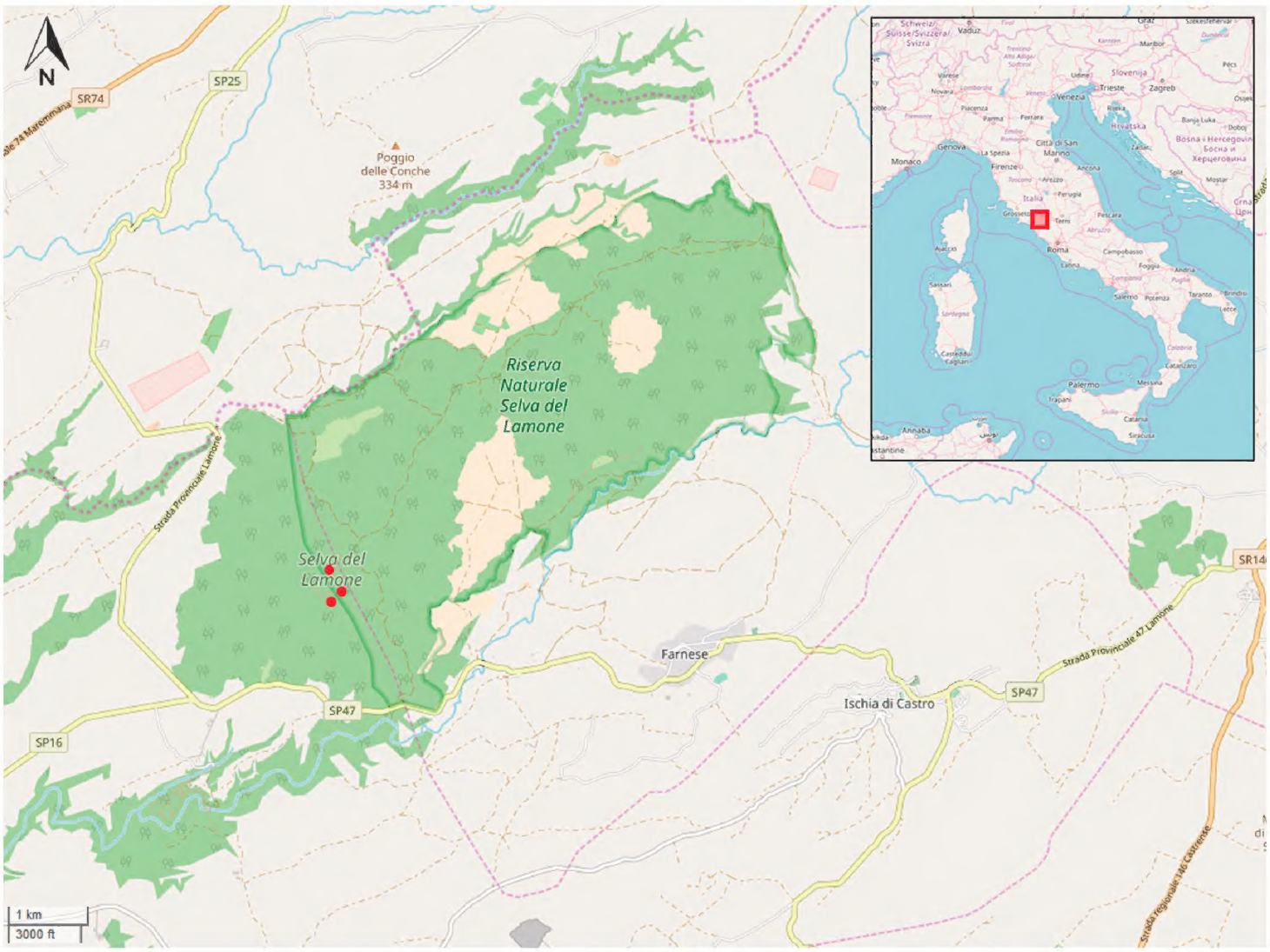

Figure 8. Distribution map of *Ophioglossum azoricum* in Italy.

scrublands (Christenhusz et al. 2017) from 0 to 1,600 m a.s.l. In Italy, it grows in clearings in a mixed oak forest (mainly with Turkey oak) on a volcanic substrate, at about 280–300 m a.s.l. (Argenti et al. 2013).

Population information: A strong decline in the number of individuals was observed in 2010 due to logging activities, but there is no further detailed information available on quantitative population estimation or on population dynamics and trends.

Threats: 5.3 *Logging & wood harvesting*. The logging activities have already led in the recent past to the reduction of the suitable sites for the persistence of the species and of the number of individuals; the risk is still present due to current forestry practices in the area, therefore, a further decline in habitat quality and in the number of individuals can be expected.

CRITERIA APPLIED:
Criterion B: **AOO**: 4 km^2 calculated with a 2×2 km-cell fixed grid.
a) Number of locations: only a single location has been identified according to threat 5.3.
b) Decline in quality and extent of habitat (iii) and number of mature individuals (v).

Red List category and criteria (regional assessment)

CR	**Critically Endangered**	**B2ab(iii,v)**

Rationale for the assessment: In Italy, this species occurs only in three sites close each other, located in northern Lazio with an AOO of 4 km^2. Due to the difficult reproduction mechanisms (subterranean fecundation) and to the scarce dispersal ability, the three small Italian subpopulations are isolated in clearings in a *Quercus cerris* L. forest occupying an area that is less than 100 m^2. The population is threatened by forestry activities linked to logging practices that also impact the surroundings of the areas of active forest utilization, particularly due to the construction of facilities for logging camps (roads and storage areas). The ongoing threats to the only known Italian population, the decline in habitat quality and in the number of mature individuals support the classification of the species as Critically Endangered at a regional level (Italy) according to the formula B2ab(iii,v).

Previous assessment: *Ophioglossum azoricum* was previously assessed at the regional level as Lower Risk (LR) for Italy (Conti et al. 1997) and, recently, as Least Concern (LC) for Europe (Christenhusz et al. 2017, García Criado et al. 2017). The species has not been evaluated at a global level (IUCN 2019).

Conservation actions: *Ophioglossum azoricum* is not protected at either regional, national or international levels. All the Italian sites are included in the SCA IT6010013 "Selva del Lamone" and two out of three are included in the Regional protected area "Riserva Naturale Selva del Lamone". Spores of the Italian population are long-term stored in the Tuscia Germplasm Bank (Viterbo, Italy).

Conservation actions needed: Further monitoring is needed in order to better understand the population trends of the species in Italy and research activities focused on its reproductive biology and ecology are recommended.

S. Magrini

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